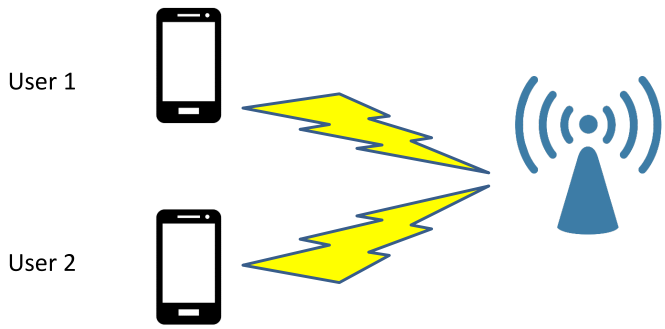
COMP 5416 Week 1

Exercise 1: Equilibrium of Two Competing Transmissions



Consider the problem discussed in the lecture, but change the utility as follows. Recompute (1) the transmission probability at equilibrium (if we do not allow pure strategy) (2) the average utility at equilibrium.

1's decision / (1, 2) utility / 2's decision	Transmit	Keep silent
Transmit	(-5,-5)	(0,15)
Keep silent	(15,0)	(0,0)

Still, user 1 transmits with probability p_1 and user 2 with probability p_2. The probabilities of the four outcomes are as follows.

1's decision / (1, 2) utility / 2's decision	Transmit p_1	Keep silent $1-p_1$
Transmit p_2	(-5,-5) p_1p_2	(0,15) $(1-p_1)p_2$
Keep silent $1-p_2$	(15,0) $p_1(1-p_2)$	(0,0) $(1-p_1)(1-p_2)$

Mean performance of user 1

$U_1=-5p_1p_2+15p_1(1-p_2)+0(1-p_1)p_2+0(1-p_1)(1-p_2)= -5p_1p_2+15p_1(1-p_2)= (15-20p_2)p_1$

Mean performance of user 2

$U_2=-5p_1p_2+0p_1(1-p_2)+15(1-p_1)p_2+0(1-p_1)(1-p_2)= -5p_1p_2+15(1-p_1)p_2= (15-20p_1)p_2$

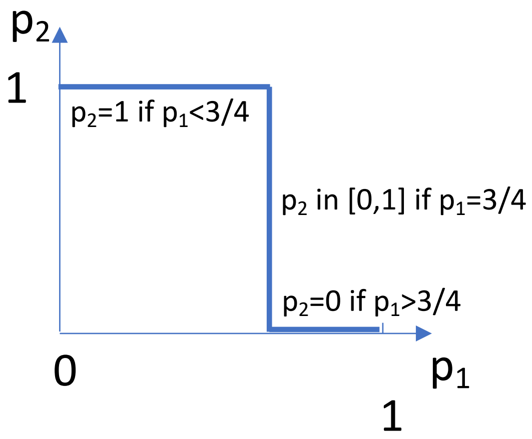
Given p_2, the optimal p_1 is

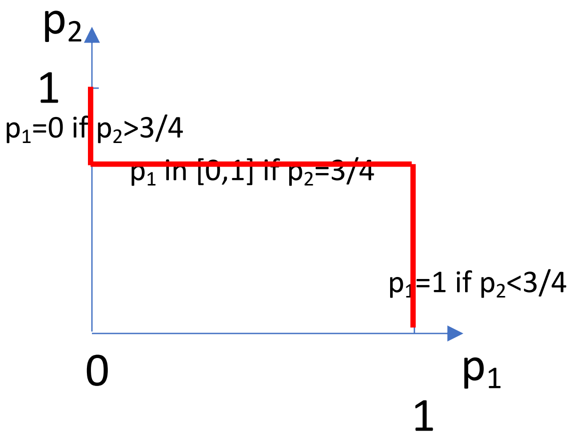
1 if $p_2<3/4$,

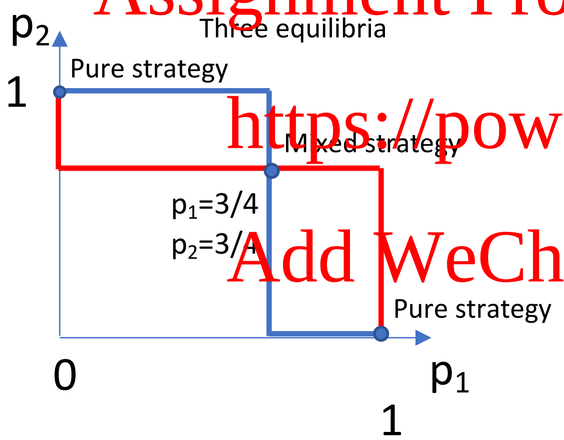
0, if $p_2>3/4$,
any value in [0,1] if $p_2=3/4$

Similarly, given p_1, the optimal p_2 is

1 if $p_1<3/4$,
0, if $p_1>3/4$,
any value in [0,1] if $p_1=3/4$







In the mixed strategy, $p_1=3/4$, $p_2=3/4$, with $U_1=0$, $U_2=0$
Unfortunately, the output utilities are still 0 even if we change the input parameters.

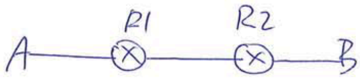
Exercise 2: Segmentation with overhead

A file of size F=300 Bytes is transmitted on an end-to-end connection over three links. The bit rate of all links is R=1000 bit/sec. Ignore the propagation delay. Assume that a header of 40 Bytes is added to each packet.

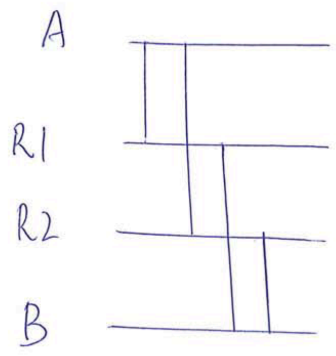
(1) How long does it take to transmit the file if the whole file is transmitted as a single packet and the nodes use the store-and-forward scheme?

(2) We would like to break the file into smaller packets to decrease the transmission time in the store-and-forward scheme. Assume that each time you break the file to make a new packet,

you have to add 40 Bytes as the header of the new packet. What should be the optimum size of the packets (including the header) to have the minimum transmission delay for the whole file? Find the total transmission delay.



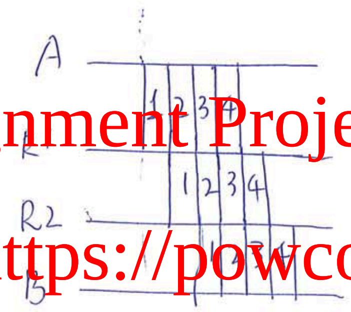
(1)



$$\frac{(300+40)\times 8}{1000}\times 3$$

$$= 8.16s.$$

(2)



$$\frac{(\frac{300}{N}+40)\cdot 8}{1000}(N+2)$$

N = 1	8.16s
N = 2	6.08s
N = 3	5.6s
N = 4	5.52s ✓ optimal N=4
N = 5	5.6s